TROPICAL AGRICULTURE

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EMPIRE SUGAR.

AT one time, it was from the West Indian Islands that Great Britain, and Europe in general, derived their chief supplies of sugar. The cultivation of the sugar cane, which replaced the previous economic crops after methods of making a crystallised sugar like the famous Muscovado had been devised and adopted, spread rapidly over the Islands, and their prosperity became intimately bound up with the crop. In response to a continuously increasing demand for sugar, production was extended elsewhere, but it was not until the effects of the policy of fostering the beet sugar industry of the continent were being felt together with other disturbing influences such as the break down of the Bourbon cane, that the British West Indies fell upon bad times. As a result of the Royal Commission sent to investigate the position of the islands; the Canadian tariff war with Germany after 1897; and later, the Brussels Convention, the British West Indies were, however, able to remain in the ranks of sugar producers, although, at present, including British Guiana, they only account for a little over one per cent. of the world's total production which is round about twenty-four million tons per annum. The most important contributor to this supply is Cuba, producing five million tons. The nearest approach is India with two and a half million tons and this is closely followed by Java with over two million tons, although, from the point of view of international trade Java is more important, for the Indian supply is consumed locally while the bulk of the Java crop is exported. It is a striking thing that of the total world production only ten per cent. is unprotected. Cuba, which sends two and a half million tons to the United States has a preference there of a farthing per lb.; sources of supply to the United States—Porto Rico, Hawaii, the Philippines and the Virgin Islands (which with the United States account for a production of two and a half million tons)—market their produce in the States duty free; Japan and Formosa protect the half million tons that they produce; in Europe, Holland's share alone, four per cent. of a total production of eight million tons of beet sugar, is unprotected. In the extension of production that has taken place in the last fifty years, the Empire has lagged behind considerably. Since 1880, the world production has increased by 700 per cent. but the increase within the Empire is only five to eight per cent. Against a total consumption, within the Empire of three million tons, the

production, excluding India, which does not export is round one and a half million tons, *i.e.*: six to seven per cent. of the world output, and fifty per cent. of this is produced in South Africa and Australia, forty per cent. in the colonies—British West Indies, British Guiana, and Mauritius—while the home beet industry is responsible for ten per cent. The preferences granted to most of the sugar producers by their governments are sufficient to give them a partial monopoly of the home market, but, although an effective stabilised preference has at last been granted to the Empire producers, only seventeen to twenty per cent. of a total consumption of about two million tons within the United Kingdom comes from Empire sources. Of late years more attention has been paid to the maintenance and fostering of the Empire industry and the efforts in these directions have been consolidated by the formation of the Sugar Federation, the objects of which are to promote the interests of the Sugar Industry of the Empire; to collect information with regard to all matters relating to methods of production, transport and marketing; to carry out a programme of propaganda and publicity with a view to increasing the production, sale, and consumption of Empire Sugar; to obtain such treatment for Empire produced sugar as will secure stability, and generally to take such action as may be considered desirable in the interests of the Empire Sugar Industry. The British Empire Producers' Organisation, of which the Sugar Federation is an offshoot, has rightly laid stress on a good deal of self help, and consistently advocated the increased application of science and organisation to the industry. Mr. Ben Morgan a short time ago, pointed out that scientific development in the Empire industry is not equal to that in the United States, Java and European countries, while, from the point of view of organisation it lags far behind. On the scientific side, the reports of research institutions in British India, Australia, Mauritius, Natal, British Guiana and the West Indies, show that valuable work can be and is being turned out. So far as the Imperial College of Tropical Agriculture is concerned, it is fitting that the long association of the West Indies with the sugar industry has been recognised in the development of an adequately equipped and well staffed department devoted specially to the theory and practice of sugar making, and to the scientific, agricultural and economic side of the industry. Prior to the opening of the sugar school at the College, it was impossible for a student to get practical and theoretical training in the making of sugar at any institution within the British Empire. Now the faster it turns out trained men the quicker will the technical standards of the Empire sugar industry industry be assimilated to those of other countries. No less important than teaching is the pursuit of research, and a perusal of the pages of the supplement on " Sugar " which is issued with the current number of *Tropical Agriculture*, will show that the College is equipped for work in this direction, and its value can be greatly increased by a continuance of the support that has already been accorded by all those connected with the industry. The scientific side of the industry—the breeding of canes possessing the best commercial characteristics, the investigation of pests and diseases by mycologists and entomologists, the survey of soils by chemists, the improvements in method by the agronomist, the agricultural engineer, and by the sugar machinery designer—has had attention paid to it for some time, but the economic side has been relatively neglected and it is good to see that the Sugar Federation is also laying stress on this as well as the agricultural and manufacturing aspect. One of the troubles of the economist is the lack of respect accorded to him because his subject has no technical jargon which makes it incomprehensible to the general public. Consequently every man regards himself as a competent judge and advisor on all economic problems that come within his experience, and while he would call in the doctor to attend to his physical ills, he would scorn to refer any economic difficulties to a specialist. One is thankful to say, however, that this attitude of mind is undergoing some modification—economists are increasingly being called in to report on the economic ills of states and are being recognised by industrial and agricultural enterprises. Mr. Kemmerer, of the United States re-organised the monetary system of the Philippines and recently reported on economic conditions at the request of the Government of Ecuador; Mr. Henry Clay, of the University of Manchester, England, was called in by South Africa to advise on its economic policy; Sir Josiah Stamp, a distinguished English statistician and economist was appointed President of the Executive of the L. M. and S. Railway after the amalgamations of a few years back. Even if called in for advisory work on any particular problem, the economist is often under greater difficulties than other investigators, in that he has much less to go upon and must himself collect relevant matters of fact before being able to apply the teachings of economic science. A doctor has all the facts of anatomy and physiology at his call when he examines a patient, but an economist making a study of the sugar industry, for example, needs considerable supplements to current statistical and general information before he can even start his work, and this information, by reason of the wide distribution of the industry, is beyond the capacity of the single worker to collect. The Sugar Federation intends giving attention to this question and its plans for the collection and dissemination of this information are awaited with interest. We suggest that something of the nature of the admirable questionnaire drawn up by the Society of Chemical Industry when it pursued an inquiry into sugar after the war, be submitted periodically to the producing countries and steps taken to ensure as far as possible that the returns be complete. A table compiled from these returns would give an excellent survey of standards of production in different

countries, and would open the way to comparison and the adoption of the methods, if practicable, of the countries with the best standards. The practical man might say that these figures, though interesting, are hardly of such value as to repay the trouble of collecting them, but, he must know that the statesman, the economist, and the business man have often occasion to refer to such figures as are available to help them to solve the problems that confront them—usually the available figures are inadequate or out of date, and action based on them is uninformed. Indeed, it is a constant cry that when questions of sugar are discussed in Parliament members display a colossal ignorance of the facts and act accordingly. Apart from the industry as a whole, the conditions in different parts of the Empire and the conditions of separate business units could be improved by studies of their economics and methods of administration. Mr. Pooley, the Secretary of the B.E.P.O., in the admirable survey of the Caribbean Colonies which he published after his recent tour, calls attention particularly to the benefits of cost accountancy and co-operation. In the development of the technique for both, there is scope for the abilities of those engaged on the administrative side of the industry. The objects of the Sugar Federation give some hope that at last the economic side of the industry is to receive adequate treatment, and the work that is adverted to in our supplement shows that facilities exist for bringing the scientific side of the Empire industry up to current outside standards, if not beyond. Improvements resulting from these developments, accompanied by any fiscal aid that may be shown to be politic, will help the Empire Sugar Industry to assume that increasing importance amongst sources of supply that is the hope and expectation of all those who have busied themselves in its cause.

AGRICULTURAL RESEARCH COUNCIL.

Reports of Research Institutes.

It has been decided by the Agricultural Research Council that copies of its annual paper dealing with reports on research work carried out at agricultural research institutes in England, Wales and Scotland shall be made available. Research, advisory, and educational workers can procure the Council Paper No. 70 dealing with the work of the academic year 1925-26 from W. R. Black, Secretary, Agricultural Research Council, 10, Whitehall Place, London, S.W.1. This paper gives an account of the work and publications of twenty-four institutions carrying on investigations with regard to soils and plants, animal nutrition, agricultural economics, and agricultural engineering.

The Editor regrets that it has not been possible to include comments on the Colonial Office Conference in the current number.

JUTE IN TRINIDAD.

Further Notes on the Possibilities.

G. EVANS, C.I.E., M.A.

IN *Tropical Agriculture* (Vol. III, p. 240), a reference was made to the possibilities of introducing jute cultivation into Trinidad, and an account was given of the requirements of this crop in the matter of fertilizers, cultural methods, seed rate, spacing and time of planting. It was then pointed out that this crop was only in the preliminary stage of experimentation in this colony and that results of the trials were not yet to hand.

Preliminary tests were carried out at the College last year with two varieties, one of the long podded species (*C. olitorius*) and the other of *C. capsularis* in which, as the name implies, the seed is carried in a round capsule.

Both these species were tried on the College plots; one series was planted on 10th August, and the other on 5th September. The methods of harvesting the crop and retting the fibre were demonstrated to the planting community towards the end of November and the task of computing the yields from the various plots was entrusted to two post-graduate students (Messrs. A. de K. Frampton and E. F. Martin). Nine plots 50 feet by 50 feet were selected from each block, the areas selected being as near the average as could be judged by the eye, and "outside row" effect was carefully avoided. The plots were labelled as follows:—

A. 1 *C. olitorius* from Trinidad grown seed sown 10th Aug.

B. 1 *C. olitorius* from Trinidad grown seed sown 5th Sept.

A. 2, A. 3, A. 4 } *C. capsularis* from Trinidad grow : seed sown 10th Aug.

B. 2, B. 3, B. 4 } *C. capsularis* from Trinidad grown seed sown 5th Sept.

A. 5 *C. olitorius* seed newly imported from Bengal sown 10th Aug.

The yields per acre were computed as follows:—

Plot No.	Green jute tons.	Clean fibre lb.	Seed lb.
A 1	14·64	1330	1055
A 2	7·34	805	667
A 3	10·8	940	784
A 4	6·0	672	601

Plot No.	Green Jute Tons.	Clean Fibre. lb.	Seed lb.
A 5	9·57	1344	667
B 1	4·04	530	434
B 2	4·72	530	468
B 3	4·17	454	500
B 4	3·92	454	601

These experiments are of course only preliminary and were of necessity limited in their scope, but one or two points stand out and seem to indicate the line on which future experiments should be conducted.

The *olitorius* variety gives the best results and seems to be best suited to local conditions. This is perhaps natural as the conditions in Trinidad more closely approximate those of Western Bengal where this type is most usually grown on high lands, than of Eastern Bengal, where the land is flooded during the latter part of growth, and where the jute plants continue to grow with the lower portions of their stems under two or three feet of water. Under these swampy conditions the *capsularis* variety does better. It was noticed in Trinidad that this type showed a tendency to branch low down and flower early under our drier and better drained conditions and this of course resulted in a shorter and therefore less valuable fibre than was the case with the *olitorius* types.

Another point that is apparent is that the earlier planted plots gave far heavier yields than the plots planted in September. The latter had too short a growing season and were checked by the Indian summer in October which usually means a dry spell. It seems probable that better yields would be obtained by earlier sowings, and plantings will be made earlier during June and July during the coming season.

Taking the results so far obtained, however, they are sufficiently encouraging to justify the hope than when planted earlier and with increased experience in the most suitable types of soils and methods of cultivation, satisfactory yeilds of *olitorius* jute, at any rate, can be looked for.

The economic side of the question is, however, more problematic, and will need careful consideration—Figures of the cost of production in Bengal have recently been obtained and I am indebted to the Fibre Expert to the Government of Bengal (Mr. Kenneth McLean) for the following estimate of costs.

Mr. McLean writes that " the following figures for high land should be what you want. I take it that your planters have modern implements and that they use bullocks. If mules are used the figures will be wrong especially if gang ploughs are used. You will be able to fix this yourself taking into account the acreage done by your own implements.

Cost per acre.	Men employed units per acre.	Bullocks per units per acre.
Ploughings (Punjab Plough) 4	4	4
Rolling (Cambridge Roller) 2	4	4
Laddering 2	6	6
Country Plough 2	4	4
Manuring ..	10	3
Sowing ..	2	1
1st weeding and thinning ..	30	..
2nd weeding and thinning ..	30	..
Harvesting	10	..
Steeping ..	10	..
Extracting ..	20	..
Drying and bundling ..	10	..
Marketing ..	2	1
	142	23

Our costs are at present roughly -/8/- annas a day for labour and -/10/- annas a day per pair of bullocks.

This makes the cost per acre to be Rs. 71/- for labour and Rs. 15/- for bullocks—Rs. 86/- per acre.

These figures are instructive. Bengal is a densely populated agricultural country and a country of small holdings. Labour costs, it will be seen, are low compared with Trinidad and the Bengali cultivator has years of experience in jute cultivation behind him. He, therefore, starts with a big advantage.

If, therefore, jute is to have a chance in this part of the world, the higher price of labour will have to be compensated for by the using of labour-saving machinery, and such machinery for dealing with the preparation of a marketable fibre from the jute stems is not yet, I believe, satisfactory, as the retting and stripping of the fibre present certain difficulties.

Herein lies the difficulty in the successful introduction of jute as a paying crop into Trinidad. It is just possible that mechanical genius may yet invent machinery which will cheapen the cost of production, since it is possible that the lower cost and abundance of labour in Bengal has not yet forced the necessity for a systematic enquiry to be made into improved labour-saving devices in this direction.

N.B.—A rupee is now equal to eighteen pence and an anna is about equal to a penny.

SOILS OF TROPICAL AFRICA.

Soil Survey of British Tropical Possessions.

BY F. J. MARTIN, M.A., Ph.D. (CANTAB.), F.I.C.
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FOR the practice of farming and for the development of agricultural industries a thorough knowledge of the soil is essential. It does not matter how this knowledge has been acquired, whether through the experience of generations of farmers or through the assistance of chemists in laboratories. In civilised countries where the majority of the cultivators of the soil are literate, and where the methods of cultivation are based on the experience of many generations of intelligent farmers, agriculture had reached a high level before the advent of the chemist and his laboratory. Rotations, fallowing and manuring were all practised and a knowledge of the soil—not necessarily expressed in chemical terms—had been gained and passed on from one generation to another. In more recent years this knowledge has been augmented by the chemist, and the pioneer work of specialists like Lawes and Gilbert has laid the basis for a more intelligent development of an already highly specialised industry.

In backward countries with illiterate inhabitants, such as are frequently met in our tropical African colonies and dependencies, agriculture is as yet in a comparatively undeveloped state. The indigent population does not appear to have accumulated through the centuries so sound a knowledge of agriculture and soil as that found in European countries. This may be due to a more limited intelligence, a more unsettled mode of living, the lack of the incentive of the colder and less hospitable climates, or perhaps, the agricultural problems of the tropics are more difficult of solution than those of temperate climates. It must not be supposed, however, that the natives of tropical countries have developed no system of agriculture, on the contrary throughout the whole of tropical Africa the system of "shifting agriculture" is practised, and a scientific basis can be found for it. Dr. H. L. Shantz (*Education in East Africa*, London) commenting on this form of cultivation draws attention to the fact that "by the rotation of land the native insures new rich soil free from harmful bacteria, fungi and insects, thereby avoiding the two greatest problems of modern agriculture, the maintenance of soil fertility and physical condition and the avoidance of plant diseases."

Shifting Cultivation.—As this is the common method of native cultivation in tropical Africa a short description of it is not out of place. A piece of land is selected—either forest or the oldest bush land obtainable—and the vegetation cut down during the dry season and burnt. In the following rainy season the crop, rice or maize or some other food crop, is sown, while in among this crop are planted cotton, cassava, &c. The land is retained under cultivation for one to three years according to circumstances and then allowed to revert to bush to regenerate. In Sierra Leone the land is generally cultivated for one year only, in Nigeria for two or three and in East Africa for about the same period. It would seem that the amount of rainfall may have something to do with this period. In Sierra Leone, where the precipitation varies from 100-150 inches a year and nearly all falls in six months, the rain is often so torrential and soil erosion and soil leaching are so excessive where the land is cleared for cultivation, that the soil will not grow a good crop for two successive years; in Nigeria and East Africa where the rainfall is not so heavy, erosion and leaching are not so serious.

It might seem that this method of agriculture which allows for regeneration of the soil has little against it. There are, however, two points about shifting cultivation which need serious consideration. Firstly the amount of labour required per acre exceeds that on land kept under continuous cultivation, and secondly where the population is dense, as in some parts of West Africa, or where the natives are restricted to reserves which in time may become thickly populated, the amount of land per person may become so limited that not sufficient time is left between crops for the land to regenerate; the soil may therefore gradually decrease in fertility. Evidence in support of the first point was forthcoming at the recent (March, 1927), West African Agricultural Research Conference in Nigeria, and at Ibadan a most interesting series of rotations designed to replace shifting cultivation in Nigeria is being carried on. These rotations which include food crops, money crops and green manure, have been going on for four years, and under the successful rotations, the soil, judging by crop yields appears to be maintaining its fertility. The amount of labour required for the continuous cultivation of land as against that for shifting cultivation is being carefully worked out. At the present rate of production it appears that continuous cultivation requires less labour than shifting cultivation.

The amount of time required for regeneration of worked-out land depends on the type of soil and the climatic conditions, and varies from some five years onwards, about 8-10 years is considered a suitable period in Sierra Leone. Estimates based on acreage per native inhabitant in Southern Rhodesia and Uganda indicate about one acre is required for the support of each native (H. L. Shantz *loc. cit.*) and on this estimate and assuming the land to be farmed once in 10 years, each square mile of country will only support 64 natives. It is usually not possible to cultivate 100 per cent. of the soil on account of hills, swamps, reserved forest areas, &c., and already in the more thickly populated parts of West Africa there are evidences of deterioration of the soil. In Sierra Leone, where the average density of the population is 57 per square mile, a considerable proportion of

the forests have within the memory of man been destroyed by this system, and the fertility of the soil in the much farmed districts is decreasing.

This type of agriculture differs greatly from that obtaining in dry tropical countries such as the Sudan. Here the native cultivator depends for his water on the Nile, and with sagia (1) and shadoof (2) the native laboriously removes enough water from the Nile to irrigate his crops. In Lower Egypt the flood water of the Nile, controlled by dams, is used for cultivating crops, and last year a dam at Sennar made possible the irrigation by gravitation of 300,000 acres of land in the Blue Nile Province, Sudan.

These two types of cultivation have their two distinct problems, the extremes of which are seen in the almost rainless parts of the Sudan (about 7 inches a year at Khartoum) and that excessively rainy country Sierra Leone (about 150 inches a year at Freetown). The soil of the Sudan contains much clay and is alkaline whereas the soil of Sierra Leone contains little clay and is acid.

It is extremely interesting to compare these two diverse types of soil. The black cotton soil of the Gezira, Sudan, is a heavy clay soil containing about 55 per cent. of clay yet, owing to the excessively dry climate, little difficulty is experienced in working it. This soil is irrigated, as much as 350 to 400 cubic metres of water per acre being used at each watering (say 3 inches deep all over) and this amount of water is applied every 14 days during the cotton growing season. So dry is the climate, however, that between waterings the ground becomes hard and cracked. In general the soil contains much salt (from .08 per cent. in the first foot to .6 per cent, in the fourth foot) and is very alkaline having a pH value of about 9.0. The agricultural problem here is to keep down alkalinity. Other soils in the Sudan are not so alkaline a figure of 8.5 being more usual. The red sandy soil of Kordofan—the soil most similar to anything in Sierra Leone—has little clay, a low salt content, but a pH value 8.5. The appearance of the soils in arid regions is very deceptive, on one occasion a soil in a friable condition was found to contain 75 per cent. of clay and on another a soil described as a desert "sand" yielded over 30 per cent. clay. The most characteristic feature of the soils of the Sudan is the almost complete absence of stones, only a few stones of a small size being found.

In Sierra Leone for the most part the soils are excessively stony, large concretionary lateritic stones, with a high iron content, forming from 30 to 70 per cent. of the soil. The clay content is low as is also the salt content and the soil is acid, the pH being about 5. The problem here is to reduce acidity. Where clay does occur the soil frequently appears much heavier than the mechanical analysis would indicate; thus a soil described as a "clay" soil was found to contain less than 20 per cent. of clay and this should be contrasted with the desert "sand" mentioned above. It might be thought that for soils with the same clay content the alkaline soils should be the heavier in texture, but the climatic conditions in which the soil occurs must also be taken into account, and probably they play a bigger part in determining the texture of the soil.

Another interesting feature showing the effect of climate on soils is shown by the chemical nature of the clay fraction. In the Sudan the ratio of silica to alumina is high and varies from 3 to 4, in Sierra Leone it is low and varies from 1 to 2. It must not be thought from the preceding paragraph that the apparent heaviness of the "clay" soil in Sierra Leone is due to this difference in the composition of the clay fraction, on the contrary, Dr. A. F. Joseph (*J. Agri. Sci.*, 1926, p. 496) has shown that there is evidence that the higher the silica/alumina ratio, the greater the plasticity of the clay.

It is well known that the weathering agents in wet tropical countries play a very important part in the decomposition of the rocks forming the soil. The action of weathering in tropical countries where the rainfall is high, say 60 inches a year or over, is more or less as follows: The sodium, potassium, most of the calcium, &c. is washed away, much of the silica is also removed, leaving as the chief constituents of the soil, alumina and iron oxide. There is, in all the lateritic soils examined by the writer, still a fair proportion of silica in the clay fraction and it is rarely in Sierra Leone that this falls much below 20 per cent., but in the concretionary masses in the soil it may fall as low as 12 per cent. This 12 per cent. of silica contains quite a proportion of quartz particles embedded in the concretionary masses but these particles can not be separated out during analysis and estimated separately. The combined silica therefore probably does not exceed, if indeed it reaches, half this amount (12 per cent.) in the lateritic concretions. By the definition of Fermor (*Geol. Mag. N. S. Decade V*, Vol. VIII, 1911) the term "laterite" should be restricted to soils containing 90 to 100 per cent. of lateritic constituents (the oxides of aluminium, iron, titanium and manganese which are more or less hydrated) and this means that apart from quartz particles, which are regarded as impurities, not more than 5 per cent. of combined silica can be present. From experience of the clay fractions of soils the writer thinks that such soils are very limited in extent at any rate in West Africa, a coast noted for its lateritic soils.

Soils containing from 10 to 20 per cent. of silica with a silica/alumina ratio in the clay of 1 to 1.25 are much more common. In appearance they are a rich red colour, somewhat darkened by humus on the surface, and containing a varying proportion (20 to 70 per cent.) of characteristic lateritic concretions; these concretions usually contain a high proportion of iron (30 to 50 per cent. Fe_2O_3).

In tropical climates where the rain is less heavy than in Sierra Leone there is a bigger diversity of

(1) Water wheel worked by cattle.
(2) Lever and bucket system worked by hand.

soil types. In Central Africa where the rainfall varies from 40 inches to 80 inches a number of different types of soil occur. Red loam soils are developed in those regions where the rainfall is of an intermediate character and not high enough for the development of laterite soils. It occurs all over Central Africa and is regarded as a very productive soil, the younger red loams especially so. The lateritic red loams are generally associated with regions of higher rainfall. Ferruginous red loams are also common in Central Africa.

In East Africa we get away somewhat from the prevailing red tint of Central and West African soils although red soils occur in this area. In Kenya and Tanganyika, chestnut brown soils, chernozen soils, and light coloured soils of the same group are found. Here the rainfall is less and the soil is capable of cultivation on entirely different lines from the soils in West Africa.

Soil Survey of British Tropical Possessions. There are not many accounts published recording the results of analysis of tropical and sub-tropical African soils, and records to which the writer has had access—both published and unpublished—are confused by the fact that the analyses have been made from such diverse points of view that the results of the work from two countries are often not comparable. It is on this account that the writer wishes to put forward a plea for the standardisation of methods of soil analysis so that the work of the chemist in one colony is directly comparable with that in another, and the accumulation of the soil investigations of the British chemists in the tropics will eventually resolve itself into a soil survey of British tropical possessions.

During 1926, the writer, while in England, drew the attention of various authorities to the lack of uniformity of methods of analysis employed by agricultural chemists and to the fact that the various determinations made, and the methods of expressing results were such, that it was often difficult, sometimes impossible, to compare the results of soil analyses recorded by different workers.

Recently, Sir John Russell, the Director of the Rothamsted Experimental Station, submitted a memorandum to the Secretary of State for the Colonies on a " Proposed Soil Survey of those parts of Africa associated with the British Empire." This memorandum was circulated to the various Colonial Governments concerned and will be discussed at the Imperial Agricultural Research Conference to be held in London in October, 1927. Sir John Russell drew attention to the desirability of soil investigations and to a soil survey built up by the accumulation of those investigations. He emphasized the fact that in order to get a definite comparison between soils of different districts it is essential that certain minimum data shall always be available. The determinations which he considers the essential minimum for characterisation are :—

1. Amount of organic matter and of nitrogen.
2. Degree of acidity (pH value) or amount of calcium carbonate.
3. Mechanical analysis, particularly the amount of the coarse and the clay fractions.
4. Ratio of alumina to silica in the clay.
5. Amount of soluble salts present if above a certain minimum.

Other determinations of value are :—

1. Exchangeable bases.
2. Lime requirement.
3. Iron and alumina.
4. Phosphate and relatively soluble potassium.
5. Carbon, organic and inorganic.
6. Nitrate, but for this, single determinations have little value.

Sir John pointed out that there is no sharp line of demarcation between the two lists and that it would be a matter for discussion where an agreed line should be drawn.

At the first West African Agricultural Conference held in March this year, a paper by Messrs. Martin & Doyne was read on " Soil Investigations in Sierra Leone with special reference to a Soil Survey of West Africa." The paper indicated the nature and extent of the soil investigations carried out in Sierra Leone since the establishment of the Division of Research, and drew attention to the need for uniformity in soil survey work. It was suggested that if the same methods of sampling and analysis were adopted throughout the West African Colonies, then in a few years time the accumulations of results from the various laboratories would provide the material for a soil survey of the West Coast. The Conference was in entire agreement with this view and the Chemical Committee considered in detail the various methods of analyses compiled by the authors of the paper. Agreement was reached along certain lines and a report was drawn up by the writer (who acted as Secretary for the Chemical Committee) embodying the methods that the committee recommended should be provisionally adopted in West Africa. The report will be submitted to the Imperial Research Conference for their further consideration.

In general, the methods of mechanical analysis recommended, follow closely those of the sub-committee of the Agricultural Education Association, with the exception that hydrogen peroxide treatment was not recommended, since our humus is generally low, and hydrogen peroxide not very stable in the tropics ; it also lengthens the process of analysis.

The committee considered the question of " oven dry " *versus* " ignited " fractions and decided, in view of evidence with regard to clay fractions put forward by the writer, to determine the clay both on the " oven dry " as well as the " ignited " basis recommended by the Agricultural Education Association sub-committee. More recent research has shown that all the fractions from lateritic soils lose " combined water " in accordance with the degree of laterisation. As most of the soils in West Africa and other humid tropical countries are more or less lateritic, this is a most important point and there are

consequently grave objections to igniting the fractions of soils, when lateritic soils are included among those being surveyed.

The determinations which the committee considered the minimum essential for characterising a soil are given below and it will be seen that this list agrees closely with that suggested by Sir John Russell :—

1. Mechanical Analysis—including amount of calcium carbonate where present.
2. Organic matter in first foot samples.
3. Acidity or alkalinity expressed as pH values.
4. Total Nitrogen on soil types.
5. Analysis of the clay fraction of soil types. This analysis should include determination of silica, alumina, iron and "combined water."

The committee realised that other determinations such as soluble salts, lime requirement, phosphate, potash, nitrate, &c. yield valuable information but they were not included in the list of essential data ; it was left to the discretion of the chemist concerned to decide which determinations were likely to be most valuable to supplement those indicated in 1-5 above.

The unanimous feeling among the agricultural chemists of the West Coast of Africa that some standardisation in soil survey work is a matter of great importance in West Africa, leads one to the conclusion that the adoption of some such standards in soil investigations would be of even greater value if applied generally to our tropical colonies. The writer in studying the crops of other tropical colonies, and the conditions under which such crops are grown, has often found it difficult to get a clear idea of the soil conditions obtaining, sometimes because information is lacking and sometimes because the determinations made, the methods of analysis used and mode of expressing results make comparisons difficult. While there is, doubtless, much that can be said in favour of any of the methods employed and determinations made, it is thought that the advantages to be obtained from a uniform treatment would greatly outweigh any disadvantages that might result from changes in methods in any particular country.

Soil surveys carried out under uniform conditions would be of great value not only to the countries in which they are made but they would be useful elsewhere. Such surveys should afford to the agricultural staffs of the colonies a valuable guide as to how far the system of agriculture or the varieties of crops suited for one region might reasonably be expected to suit another. This information should prove of great value in developing the agricultural potentialities of little known countries and should act as a guard against the numerous disappointments experienced in the past when projects have been undertaken without a sufficient knowledge of the soil and climate. It should be emphasized that no soil survey is complete without meteorological data of the region surveyed.

COTTON.

Cost of Production.

THE present low prices for American cotton consequent upon exceptionally large crops is likely to have an important effect within the British Empire. The dominating factor must be the cost of production and marketing ; ideal information with regard to such cost is extremely difficult to obtain, and we therefore reprint below extracts from an article, which appeared in a recent Supplement to the *African World* on "Cotton Growing within the Empire" having special reference to the cost of producing cotton in Africa.

"In Queensland £4 is recognised as a fair figure for the cultivation of one acre under cotton, but this does not include rent or interest charges. Assuming a yield of 1,000 lb. of raw cotton, which is above the average, the cost of picking (unless picked by the grower's family) would be £8 6*s*. 8*d*., sacks and pressing 17*s*. 4*d*., haulage and inward freight to the ginnery 12*s*. 6*d*. ; or a total cost to the grower of £13 16*s*. 6*d*., representing 3·31*d*. a pound, of which 2*d*. is absorbed by picking costs. If the picking is to be performed by the grower's family then acreage will be controlled by its picking capacity.

Taking the above price of seed cotton and allowing a lint production of 28 per cent., the estimated cost of placing 1 lb. lint on the Liverpool market, excluding Liverpool dock dues, warehousing and brokerage, would be not less than 15·78*d*. This figure is arrived at as follows :— Lint 11·85*d*., ginning 1·25*d*., freight and insurance 2*d*., other charges 0·68*d*. (If the seed were sold at the rate of £6 a ton the cost of the lint could be reduced by about 1½*d*. a pound.) From these figures, which are substantially correct, it is evident that only the highest standard of farming producing high-quality lint, combined, with close co-operation among growers and others concerned with the welfare of the industry, will enable it to survive a period of depression. Reduction of picking costs is imperative. Mechanical pickers cannot replace human fingers where quality of lint is of first importance. The average cost of picking in the United States is not more than ¾*d*. a pound ; in Africa and India the cost is probably less than ¼*d*. a pound. Under the State system of guaranteed payments the less last season to the Queensland crop was about £90,000.

In Uganda the average price of raw cotton last season was 18 cents a pound. At this rate 1,000 lb. of seed cotton cost £9 (7·71*d*. a pound of lint) ; ginning, baling, and storage of 280 lb. of lint £2 8*s*. 8*d*. (2·10*d*. a pound) ; inland freight 10*s*. 6*d*. (0·45*d*. a pound) ; ocean freight and insurance 14*s*. (0·60*d*. a pound) ; cotton tax at 6 cents 16*s*. 5*d*. (0·70*d*. a pound) or a cost of 11·56*d*. a pound, out of which the native grower received 66 per cent. This is a close approximation of costs to Liverpool. In view of the altered conditions Uganda growers will probably be offered not more than half the above price next year, and the spirit in which the

lower price is accepted will go far to decide the future of the crop. The numerous small ginneries in various stages of efficiency scattered throughout Uganda do not make for economy in handling the crop; freight charges are also unfavourable when compared with the rates for other produce carried over the Uganda (Kenya) railway; for instance, one ton of maize can be carried from Kisumu to Kilindini, a distance of 500 miles, for 11s. The Uganda cotton tax will be reduced to about 3 cents for next year's crop.

The South African crop, with an average yield of 600 lb. of seed cotton, costs between £3 and £4 an acre to cultivate and harvest. With the price of middling American around 7*d.* a pound, a profit which will satisfy the grower is not likely to materialise. But the people who are placed in a really unfortunate position are the settlers who have acquired holdings in the new areas such as those of Northern Zululand and have put all their cleared land under cotton. The majority of these settlers have little agricultural experience, and have sunk their capital in their holdings. They have now to face a third adverse season, and it is doubtful if any but the stoutest will survive. The enthusiasm of the Rhodesian farmers for cotton-growing will also be severely tested; they are, however, used to adverse times, and the effect of a period of low prices will probably result in confining the crop to the most suitable lands under a sound system of rotations and economic farming, which is exactly what is required throughout the Empire.

As Mr. Speller points out it is misleading to talk of the production of "cheap" Empire cotton, because, with the possible exception of India, economic factors are against production. The crop may be grown and harvested in parts of Africa more economically than in the United States, but the "cheapness" ends on the European farm or native "shamba," and the expensive "on-costs" commence. The conveyance of the cotton to the ginnery, ginnery and other local charges, long and expensive inland and ocean freights, together with an uncertain period of storage at the ocean port, considerably add to the price. Sometimes the bales require to be handled seven or eight times before loading in the ocean steamer. It is well known the economics are long overdue in the present method of handling and ginning the crop where open, marked and unlimited competition exist in native areas, but whatever economics in crop control may be effected the great handicap of distance between the cotton areas and ocean ports, which will increase in course of time, remains.

THE Empire Marketing Board has had a series of posters prepared for encouraging the importation of wholesale products. The posters, size 60 × 40 inches, will be framed in threes, and will be changed periodically. The designs are by well-known artists, and depict various aspects of the production, preparation and dispatch of the principal exports of the British Empire overseas.

BRITISH GUIANA.

THE report of the two members of Parliament who visited British Guiana at the request of the Government with the object of studying the economic resources of the Colony has now been published (Cmd. 2841, 1927). British Guiana is slightly larger than Great Britain and has a population of a little over 300,000 or less than four persons to the square mile. Forty-two% of the population is East Indian, 39.36 Blacks, .91 Chinese, 1.11 Europeans other than Portuguese, and 3.08 Portuguese. After the abolition of slavery, of the many trials of immigrants, East Indians proved by far the most satisfactory and were imported under the indentured system down to 1917 when the Government of India decided that emigration was to cease immediately. British Guiana is regarded as exceptionally suitable for Indian colonisation but it is thought that the last tentative proposals of the Indian Government for encouraging emigration to South America would involve the Colony in an altogether excessive expenditure to settle Indians on the land. The Commissioners are of the opinion that the Colony would be better advised to devote such resources as are available to the encouragement of immigration from the West Indies, where, especially in Barbados and Jamaica there is a surplus black population which at present seeks an outlet in Cuba, Panama, and other foreign countries. So far as the health of the population goes, the Colony's death rate is still excessively high. This is principally due to impure water supply, which conduces to such diseases as enteric fever, dysentery, and diarrhoea; to malaria which is at present unavoidable owing to the swampy nature of the soil; to elephantiasis, which we may note in passing is now being investigated on the spot by a research officer appointed by the Royal Society, to tuberculosis, due to overcrowding in unhealthy houses with closed doors and windows; to venereal disease, very difficult of control in an ignorant and promiscuous population; and to hookworm, due to faecal contamination of the soil. Many of these diseases are preventable and due entirely of unhygienic and insanitary conditions of life, and all might at least be greatly mitigated by education and propaganda and a health authority with sufficient power to enforce compliance with primary sanitary conditions. With regard to the last paragraph, it must be remembered that under the Local Government Board Ordinance of 1907, passed before the creation of the Public Health Department, responsibility for health and sanitary measures in Village districts is placed upon Local Authorities. This system of dual control give officers of the Public Health Department no *locus standi* in the village. However, with adequate funds and control, the Commissioners are of the opinion that much could be done to enlighten public opinion and to combat devastating and in many cases preventable diseases, with revolutionary effects upon the health of the people.

(*To be continued.*)

TROPICAL WORLD NOTES.

The Caribbean Colonies.

MR. H. T. POOLEY, Director of the British Empire Producers' Organisation and Deputy-Director, Sugar Federation of the British Empire recently paid a visit to the West Indies and British Guiana and has published the result of his investigations on the politico-economic positions of these historic British territories in *Empire Production and Export.* A resumé of some of the salient facts in his article should prove of interest to readers of this journal.

The West Indian planter has in the past been hampered by the lack of a coherent colonial economic policy and subjected to a political control which has been unable to provide it. The time is not yet ripe for the political federation of the British West Indies and British Guiana and self-government, nor is complete self-control by any of the constituent colonies yet feasible. Economic, and not political federation will do much towards cementing the bonds of sympathy between these colonies to the mutual advantage of all concerned. General interest in the sugar industry has been the basis of much common action in the past. It is pointed out that, "if the sugar planters had had the preference from Great Britain that common justice demanded in the openings of the bounty-fed European beet industry, the West Indies would be flourishing, British Guiana might have held the position that Cuba holds to-day, and Great Britain would be many millions richer. It is not even yet too late for much to be done, and the free import of their sugar into Britain, retaining the duty on foreign sugar at its present level, would stimulate West Indian prosperity more than any other single action, and would react in purchases from Britain that would outweigh any sacrifice of revenue." Co-operative production and marketing in the fruit industry will provide another basis for sound economic federation. Organised production and co-operation will prove a powerful political weapon in the hands of the planter, for "with organisation in a colony he can exercise influence upon his colonial government; organised collectively throughout the area, he can bring pressure, and very strong pressure, to bear on the Colonial Office. Nor is there any reason to believe that unanimous opinion of the kind would not be welcomed in both cases."

While in purely economic conditions the colonies vary markedly, with the exception of the bauxite industry of British Guiana and the oil wells of Trinidad, the prosperity of these countries depends entirely upon agriculture. The factory side of plantation industries has reached a high level, there is room for improvement in cultural methods, but what agriculture urgently demands is co-operation and good accounting. Cost accountancy is essential to obtain the most remunerative results.

One day was spent in Barbados where "there seemed to us general agreement with the proposals for a Sugar Federation of the British Empire, and with the essential need for the Colonial sugar producer to work in harmony with the Dominion sugar producer. The two points upon which most emphasis was laid were the need for an immediate declaration of a free Empire Sugar import policy by the Imperial Government to be made effective at the earliest opportunity, and an early adjustment of the British Preference to the Canadian level."

* * *

British Guiana.

The present unstable political condition of this colony is largely responsible for its unsound economic position. The suggestion that the merchants and planters should organise political action to maintain the interests of property and progress in the legislature, is difficult to achieve, since most of the large interests are governed by salaried managers, who must look for all decisions on policy to the proprietors in Britain. Moreover these representatives are chosen for their business capacity and not for their political ability. In any case, such men have little time for practical politics. A committee to advise upon methods of revising the constitution of the Colony so as to give the Crown effective financial control, has been set up.

The chief industry is sugar, and is mainly conducted by large firms who are also merchants. The factory methods are of a high order, but much attention is now being paid to the improvement of cultural practices and to the production of superior varieties of cane. There are two crop seasons in Demerara, and this, together with the shortage of labour, has led to some inevitable bad practice, such as burning cane trash, but also to much ingenuity in labour saving. The need for a further supply of indentured coolie labour from India is urgent, but a deadlock still persists between the British Guiana Sugar Planters Association and the Government of India on the issue. It is noted that "the East Indian is happy and successful in British Guiana and no effort should be spared to persuade the Government of India, for the sake of her own people, to accept terms less one-sided than their stipulations of 1925." Here again the need for thorough accounting methods and more especially cost accountancy, in the industry was manifest. "Some few estates are developing excellent systems with complete field records, and the benefit is apparent." Attention is being paid to the production of power alcohol from molasses and the processes for the compression of bagasse into board.

There is a vast potential wealth in the large forest area of the Colony, and the recent appointment of an expert conservator, together with a sound policy as to felling, grading and re-afforestation, will do much to utilise this wealth, and to conserve rather than to exploit it.

Little fruit is grown, but conditions are obviously suited to its culture. Citrus can be grown, and provided a banana resistant to Panama disease, and of suitable commercial and handling characteristics can be found, there is the possibility of the development of a considerable industry. Organisation of fruit producers has "made a beginning by a joint committee of the Chamber of Commerce, the Sugar Planters' Association, and the Farmers' Conference. This beginning will no doubt be fostered by the new Director of Agriculture, Mr. J. Sydney Dash, who, while a Professor at the Imperial College of Agriculture at Trinidad, has taken a keen interest in fruit problem."

* * *

Trinidad.

The favourable geographical position of this island has made it an important trading centre, and the merchants the most powerful element in the colony. Many merchants possess interests in agricultural property so that there is little friction between producer and merchant. Prosperity has been enhanced by the oil industry, and competition for labour has been set up.

A considerable proportion of the sugar cane grown in Trinidad is produced by small holders or cane farmers and sold to the factories of the several large estates in various parts of the colony. The Usine Ste. Madeleine is the largest estate and last year turned out 29,365 tons of sugar. Here agricultural practice, factory methods, accountancy and coordination are of a high order. Of late years yields have been much reduced by the incidence of the froghopper blight, in spite of serious attempts to control this pest. On this estate, sound agricultural methods, including clean cultivation and the introduction of short rotation crops tend to show that serious losses from the pest may be lessened in this way. It might be added here that the Department of Agriculture of the Imperial College has always advocated the need for a sound agricultural policy to mitigate the evils of monoculture, and it is gratifying that the adoption of this policy by the Usine Ste. Madeleine, has met with excellent results. In a recent article in this journal Professor J. S. Dash concluded with the following remarks, "Finally, while further contributions to our knowledge of the froghopper pest and its behaviour will be of great value, enough is already known for further steps to be taken towards mitigation of the evil. To await the arrival of some nostrum which will banish froghopper is to court disaster; therefore, let us now begin to tackle the problem seriously by adopting a sound agricultural policy which alone can safeguard the future."

Trinidad has a large cocoa industry, producing cocoa of a very high quality, a fact that alone allows it to compete with the vast production of "bulk cocoa" from West Africa. Real cooperation has been effected by the Cocoa Planters' Association, and rigorous grading steps have been adopted to maintain the reputation for quality which Trinidad cocoa enjoys in the market of the world.

The Department of Agriculture of the colony has done solid work towards the improvement of fruit culture, and the recently organised Trinidad Fruit Growers Association should do much towards the establishment of a flourishing industry.

Stress is laid upon the importance of the Imperial College of Tropical Agriculture not only to the colony, but to the Empire as a whole. "The colony presents a variety of climate and soil that with its geographical position, makes it particularly suitable for the study of agricultural problems common to tropical areas in all parts of the Empire."

* * *

Jamaica.

This is the largest of the West Indian Islands. Its proximity to the United States gives it features peculiar to itself. Although associated with the United States by strong economic ties, it is fundamentally British and this is borne out by the fact that all Americans who visit it, say they like it because it is "so British."

Part of the sugar cane produced is grown under systems of irrigation. Some of the factories are electrically driven and cost accountancy has been adopted. Generally speaking the sugar industry requires more and better cane for its factories, accompanied by improved field methods. The rum industry has suffered both from prohibition in the United States and high import duties in Great Britain.

Indian draught cattle are bred in Jamaica for export to Cuba, but little has been done to establish a dairy industry. With improved transport facilities there may be considerable scope in this direction.

With the investment of a considerable amount of capital, and with constant and careful supervision the sisal industry could be further developed to the utilisation of land which is of little value for other crops.

Of great importance to Jamaica is the banana industry, nominally there is an open market for bananas, but in reality the predominance of the United Fruit Company enables it to control price, as competition from other fruit companies cannot be considered effective. Cooperative movements from time to time have arisen to protect the interests of the producers. The Jamaica Producers' Association has very wide aims, and seeks to organise production and also marketing to the extent of providing its own steamship line. The colony is also capable of producing other fruits on a considerable scale.

This interesting survey tends to show that what the West Indies most require is, firstly, organisation of producers within each colony, and secondly, cooperation in marketing between all the colonies. In short, with economic federation, enhanced by Imperial Preference, the future of British Tropical America must rest assured. It is to be hoped that similar surveys of other parts of the British colonies will be forthcoming from the same source.

A. L. BAKER.

INSECT CONTROL IN HAWAII.

(*Concluded.*)

The Control of Injurious Plants.

THE first attempt to control a noxious plant by its insect enemies was made in the Hawaiian Islands. Nearly 70 years ago Dr. Hillebrand, the distinguished botanist of the Islands, introduced the thorny species of *Lantana, L. camara,* for ornamental purposes. This shrub subsequently spread to such an extent that it became a veritable scourge to the pastures of low lying regions, especially on the Leeward side of the Islands. It is a native of the warmer parts of America, and during a visit made by Koebele to Mexico in 1898 it was observed in its habitat and some insects were bred from *Lantana* seeds. In 1902 Koebele again visited Mexico, this time at the request of the Hawaiian Board of Agriculture and Forestry. He set out with the object of securing any promising insect enemies of the plant for purposes of introduction into the Islands. The result of his work was that 23 species of insects were sent to Perkins in Honolulu and of these eight were successfully established. Each of these eight species attacks the *Lantana* in a somewhat different way. The most effective appears to be the Tortricid moth *Crocidosema lantana,* Busck., whose larvae bore into the flower stems and consume the flowers and fruit. The larvae of the seed fly *Agromyza lantanae,* Frogg. attacks large numbers of the ripening berries, either destroying the seeds or causing the berries to shrivel up on the bushes. The Tingid bug *Teleonemia lantanae,* Dest. destroys the young leaves so effectually that extensive areas of *Lantana* are checked in growth and fail to blossom. The larvae of the Trypaneid gall-fly *Eutreta xanthochaeta,* Ald. to some extent checks the growth of new roots. The larvae of the plume moth *Platyptilia pusillidactyla* (Walk.) destroy many of the flowers in very much the same manner as those of the Tortricid already referred to; on the whole it appears to be less efficient than the latter insect. The Tineid leaf miner *Cremastobombycia lantanella,* Bucsk. is of minor importance but its larvae when abundant cause the premature death of the leaves and to some extent restrain the vigour of the plant. Finally, two species of Lycaenid butterflies *Thecla echion* L. and T. *bazochii,* God. are important since their larvae destroy a great many of the flowers and thus restrain the production of the berries. Unfortunately the Chalcid *Pantarthron flavum,* Perk. parasitises the eggs of the Theclas to some extent, while on the other hand the larvae of T. *echion* have proved not entirely harmless to garden plants, being occasionally found feeding on fruits of the egg-plant. The most valuable of the insects just enumerated are those which inhibit seed-production thus minimising the further spread of the *Lantana* and of its reinfesting land from which it had been eradicated. By the year 1905 the introduced insects had become generally distributed through most of the islands. The increase of some of the species in their new surroundings was phenomenal. Thus Perkins mentions that only three months after the last insects were liberated the *Agromyza* was already in countless numbers and along a mile strip of abundant *Lantana* in one locality it was hardly possible to find a sound berry. The various introduced insects have proved most effective in the drier regions, and in such localities at the present day it is difficult for a visitor to form an adequate conception of the original infestation by this shrub. For many miles in different directions around Honolulu the writer found that all that is evident is the presence of scattered bushes along the roadsides and here and there a denser growth on rough lands adjoining the coast. In the Island of Hawaii there are, however, large areas on the sites of some of the older lava flows. The presence of the plant under these conditions does not appear to be directly harmful since little else will grow in such situations and the roots of the *Lantana* are evidently aiding the conversion of the lava into soil. In Maui Island the plant is controlled very much in the same degree as in Oahu Island. In addition to the insects already enumerated the scale *Orthesia insignis,* although a dangerous pest of polyphagous habits which has been accidentally introduced, shows a marked predilection for *Lantana,* killing out the latter in places. It is also worthy of note that where *Lantana* grows down to the shore it becomes killed out apparently by the salt spray driven inland by the sea.

Another noxious weed which has gained a footing in the islands is Pamakani (*Eupatorium glandulosum*) which is also native to Mexico. It first appeared on Maui Island, where it has now become a serious pest on the ranch lands, besides being established on the islands of Oahu and Molokai. In May 1923, H. T. Osborn, who was at that time already engaged in entolomogical work in Mexico, was requested to investigate the occurrence of the plant in that country and the possibility of controlling it in the Hawaiian Islands. His observations indicated that Pamakani is troublesome on the Mexican ranches but under greater restraint than in Maui Island. The relative values of the different factors involved in its control are possibly somewhat complex, but it appears that competition with other plants probably plays a much more important part than insects. Upwards of 50 species of the latter were found by Osborn to attack this weed and it is possible that certain of these might prove more effective under Hawaiian condition than in Mexico. It is not, however, advisable to attempt the introduction of any of these forms until their bionomics has been more adequately investigated.

The obnoxious tropical sedge known as nut grass (*Cyperus rotundatus L.*) probably entered the Territory about the roots of imported plants and has since become a pest plant. Efforts are

being made to introduce and establish a weevil and a Tortricid from the Philippines with a view to its control. A small consignment of these insects has been received in Honolulu and the experiment will be watched with considerable interest. Exceptional care is obviously required in order to ascertain whether these imported beneficial insects are likely to remain specific to their host plant, under a new environment, and not become enemies of forage grasses, &c.

The writer observed considerable areas of furze over grazing land on the slopes of the mountain Haleakala on Maui Island. It was not possible to gather any information relative to the incidence of this plant, but it appears not unlikely that it may, in future, become a pest of importance in the absence of any efforts at control.

Summary.

1. Insect pests in the Hawaiian Islands are, with few exceptions, immigrant species from other countries. Their control by biological methods dates from 1890, when A. Koebele introduced *Novius cardinalis* for repressing the cottony cushion scale, *Icerya purchasi*, and the experiment was completely successful.

2. The sugar cane leafhopper, *Perkinsiella saccharicida*, has been suppressed by the combined activities of several imported species of Chalcid egg-parasites, followed by the introduction of the predaceous Capsid, *Cyrtorhinus mundulus*, from Fiji and Queensland.

3. Satisfactory control of the sugar cane borer, *Rhabocnemis obscura* has been achieved in most infested areas by the Tachinid *Ceromasia sphenophori*, introduced from New Guiana. In certain districts, under bad climatic conditions, outbreaks still occur and efforts are being made to meet the situation by introducing other beneficial insects.

4. Efficient control of the beetle, *Anomala orientalis* has been obtained by the introduction of the wasp, *Scolia maniliae* from the Philippines. This pest has not since increased to its former destructive proportions.

5. The Avocado mealy bug, *Pseudococcus nipae*, affords one of the most recent examples of biological control. Since the importation of the Chalcid parasite *Pseudaphycus utilis* from Mexico in 1922 this pest has been difficult to find in many districts.

6. The indigenous Pyralid leaf-rollers *Omiodes accepta* and *O. blackburni* are no longer pests of serious consequence. They are controlled by several enemies, chief among them being the Braconid, *Macrodyctium omiodivorum* and the Chalcid, *Chalcis obscurata*: both parasites were originally obtained from Japan.

7. Satisfactory repression of the Mediterranean fruit fly, *Ceratitis capitata*, has yet to be achieved. The importation of parasites from Africa and Australia has markedly decreased the infestation, but their efficiency appears to be partly neutralised by the species competing against one another and supra-parasitism is prevalent.

8. The Australian fern weevil *Syagrius fulvitarsis* no longer occasions damage to tree ferns to its former extent. The recent introduction of the Braconid *Ischiogonus syagrii* from Australia has brought about this result.

9. Early introductions of various Coccinellidae, more particularly of *Cryptolaemus montrouzieri* and *Coelophora inaequalis* resulted in the complete subjugation of certain coccids and aphides.

10. Promising results are being obtained against army worms and cutworms by the recent introduction of the Chalcid *Euplectrus platyhypenae* from Mexico. The breeding and liberation of this parasite are still being carried out.

11. Control of wireworms and horn fly has not, so far, met with success.

12. The colonisation of a number of species of insect enemies of *Lantana*, from Mexico, afford the first example of pest plant control by this method. The restraint which they have exercised, more especially by prevention of seedling, has checked that plant reinfesting area previously cleared.

13. The repression of nut grass (*Cyperus rotundatus*) by the introduction of insect enemies from the Philippines is being carried out as a preliminary experiment and a survey of the possibility of controlling Pamakani (*Eupatorium glandulosum*) has been made in its Mexican habitat.

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The above article which has appeared in *Tropical Agriculture*, Vol. 4, pp. 44-46, 72-73, 94, 114, 125, 154, was reprinted from an article by Dr. A. D. Imms, Director of the Institute of Plant Pathology, Rothamsted Experimental Station, Harpenden, England, entitled "The Biological Control of Insect Pests and Injurious Plants in the Hawaiian Islands," which appeared in the *Annals of Applied Biology*. (Vol. 13, No. 3, August, 1926.)

MESSRS. JOHN FOWLER & CO. (Leeds), LTD., announce that they are now able to supply their Motor Cable Tackles fitted with high speed Diesel Engines which burn cheap Diesel oil fuel, should this type of engine be preferred. They have made exhaustive tests before deciding on the design. The engines to be fitted have proved highly satisfactory for many different kinds of work and have given consistently economical results on test. As a result Messrs. Fowler are fitting these engines into their Motor Cable Tackles but they emphasize at the same time that they do not consider that the use of Diesel engines is justified under all conditions and they prefer to have an opportunity of advising would-be purchasers after due consideration of any particular case. Messrs. Fowlers have tested these engines themselves for prolonged periods and obtained consumptions varying from 0.45 to 0.50 lb. per B.H.P. hour according to the load so that apart from the lower cost of the fuel the quantity used is over 30 per cent. less than petrol. Other advantages of the type of engine selected are :—(1) The engine will start from dead cold. (2) Starting troubles associated with Diesel engines have been eliminated. (3) The injection nozzles are of the simplest possible type, and they can be removed or replaced almost as easily as the sparking plugs in an ordinary motor car. (4) Provision is made for cutting out any number of cylinders so that for running light only one or two cylinders can be left working.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Destruction of Gossypol in Cottonseed Products.

Cotton oil contains among other impurities certain substances which impart to the oil a dark red colour. Among these substances is one which has definitely toxic properties and which has been given the name of "gossypol." All the gossypol, however, is not removed from the cotton seed during expression of the oil, and consequently the residue imparts a toxic action to the cotton seed cake prepared from the exhausted kernels and produces a deleterious effect on animals feeding upon large quantities of cotton seed cake. Its removal or destruction is therefore important.

It may be obtained from the crushed kernel by first extracting the oil with petroleum ether and then extracting the gossypol with ethyl ether. Although the kernels are subject to severe treatment in crushing and heating during the production of the oil it does not destroy, though it may change, the toxic action of the gossypol. Probably during the process the original substance undergoes molecular change into an isomeric substance named *d*-gossypol which is equally toxic. Some decomposition into other toxic compounds may also occur. The gossypol content of the cake varies considerably and seems to depend on the exact conditions of expression and heating. It is found that if instead of heating the seeds in a dry condition, when the toxic action is not reduced, the moistened seeds be autoclaved in steam at 20 lb. pressure for four hours, the toxic properties are almost entirely destroyed and the meal rendered fit for cattle consumption.

Germination does not affect the toxicity of the seeds.—(*Ind. Eng. Chem.*, Vol. XIX, p. 726.)

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The Production of Phosphatic Fertilisers.

The fact that potassium sulphate is a more desirable source of potassium for many purposes than potassium chloride necessitates the conversion of the latter into the former. This is done by the action of sulphuric acid, hydrochloric acid being obtained as a by-product during the process. High cost of transport and the necessity for highly acid-resisting containers makes the disposal of hydrochloric acid difficult, and it is therefore suggested to utilise it in the extraction of phosphate rock for the production of phosphate fertiliser instead of sulphuric acid.

In the extraction of the rock by the hydrochloric acid, a mixed solution of phosphoric acid and monocalcium phosphate is first obtained, which, if left in contact with excess rock, precipitates the dicalcium salt. The activity of the rock is soon stopped, however, by the formation of a coating of the dicalcium salt on its surface, and precipitation ceases. It is found more satisfactory to precipitate the dicalcium phosphate by addition of finely ground calcium carbonate, the evolution of carbon dioxide keeping the surface of the particles free from any deposition. The use of milk of lime gives even better results.

The dicalcium phosphate $CaHPO_4 . 2H_2O$ produced by this hydrochloric acid method contains about 40% of P_2O_5 against 16% contained in the mixture of phosphate and sulphate produced by the sulphuric acid. Moreover it is not hygroscopic nor does it revert to citric-insoluble forms, and can therefore be readily stored without deterioration.

The calcium chloride left in solution may be obtained as a by-product of some value.—(*Ind. and Eng. Chem.*, Vol. XIX, p. 349.)

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Concentration of Vanilla Extracts.

Concentration of vanilla extract by vacuum distillation is advantageous economically because of an appreciable saving in alcohol, but unfortunately it is accompanied by a distinct loss of flavour and aroma. The extent of this loss depends on the degree of concentration and upon the kind of bean from which the original extract is made.

Extracts were made of various types of beans by alcohol and acetone, and the filtered extract concentrated. As the degree of concentration increased, so there was a corresponding loss in aroma, while prolonged distillation gave a viscous, semi-solid product having practically no aroma whatsoever. Analyses of the original extract and the concentrated product showed very little change in the chemical composition, though there was a loss of volatile acids and volatile oil, and it is to the loss of these substances during concentration that the deficiency of aroma and change of flavour is attributed, and not to change in chemical composition of the remaining constituents. Analyses of the distillate showed the presence of small quantities of these volatile substances which imparted to it the characteristic vanilla odour. Tahiti vanilla extract particularly showed great loss of quality as its flavour is largely due to the volatile oil it contains.

Acetone extracts were distinctly inferior in flavour to alcohol extracts, owing to the extraction by the acetone of certain acid materials.—(*Ind. and Eng. Chem.*, Vol. XIX, p. 344.)

WE have received from Cadbury Brothers, Ltd., a copy of their Bournville publication, 1927, entitled "Cocoa, the story of its cultivation." The text is concealed in a pleasant style and is profusely illustrated by photographs and paintings from the brush of Mr. Frank Newbould. This little brochure will maintain the high standard set up by previous annual publications.

MYCOLOGICAL NOTES.

The relationship between the Phytophthorae associated with the Bud-rot diseases of Palms, by C. H. Gadd, D.Sc. (Birm.), "Ann. Bot.," Vol. XLI, No. 162, April, 1927, pp. 254-280.

The author summarises his interesting paper as follows :—

1. The general adoption of a term such as 'wilt' is urged for those ill-understood diseases of palms, in which the rotting of the terminal bud is preceded by the drooping and wilting of older leaves.

The name 'bud-rot' should be applied only to those diseases in which the rot of the bud is the result of a primary infection in or near the bud tissues.

2. The effective treatment of bud-rot consists essentially in the immediate destruction of the crowns of infected palms, whereas for 'wilt' some further measure is likely to prove necessary, the measure depending upon the ascertained cause of the condition.

3. The occurrence is recorded of a bud-rot of coconut palms with which a species of Phytophthora, possibly *P. palmivora*, is associated.

4. The occurrence of a species of Phytophthora believed to be *P. arecae* is reported as the cause of a fruit-fall and rot of the terminal bud of areca palms in Ceylon.

5. Oospores of the Ceylon strain of *P. arecae* have not been found in nature nor in pure cultures. Chlamydospores occurred in culture.

6. The similarity of the morphological characters (in the absence of oospores) of *P. Faberi*, *P. palmivora*, *P. arecae*, and *P. Meadii* is commented upon The only safe criteria for the determination of species in the genus Phytophthora are the size and characters of the sexual organs.

7. Cross-inoculation experiments with Ceylon strains from cacao, coconut, and areca are described, and biological differences between these strains are noted.

8. Experiments were carried out with mixed cultures of strains of *P. Faberi* and the strains from coconut and areca. No oospores were obtained when the areca strain was grown in mixed culture with any of the *P. Faberi* strains. Oospores were obtained in abundance when the coconut fungus was grown with a strain of *P. Faberi* from Odontadenia.

9. The Ceylon strains from coconut and cacao are of the same sex, whereas in the West Indies the strains from these hosts are of opposite sex.

10. The question of the synonymy of *P. Faberi* and *P. palmivora* is discussed. It is considered inadvisable at present to abandon, in favour of *P. palmivora*, the name *P. Faberi* for the strain parasite on cacao, although there appears to be strong morphological reasons for regarding the two as synonymous. If undue emphasis is placed on the plastic morphological characters of Phytophthora strains of which oospores are unknown, the Burma strain of *P. Meadii* and the Ceylon strain of *P. arecae* must either be regarded as belonging to the species *P. palmivora* or new species must be created to accommodate them.

11. A detailed study of the morphological and biological characters of the strains belonging to the *Faberi* group of Rosenbaum's or Lafferty and Pethybridge's classifications of the genus Phytophthora is required.

* * *

"Collar Crack" of Cacao ('Armillaria mellea' (Vahl.) Fr. by H. A. Dade, A.R.C.S., Bull. 5, Dept. Agric. Gold Coast.

The author's account of the disease includes seventeen very good photographic plates, and the following summary :—

1. Collar Crack is a destructive and rapidly-spreading disease of cacao widely distributed throughout the forest belt of the Gold Coast and Togoland.

2. Characteristic symptoms are exhibited, notably the conspicuous longitudinal radial cracks produced in the collar of the tree.

3. The causative organism is a variety of *Armillaria mellea* (*Vahl.*) *Fr.*, which is described.

4. This fungus has a very wide range of cultivated and wild hosts, and also lives as a saprophyte on dead wood.

5. The histology of highly organised tissue which protrudes from the cracks is of interest as linking the structure of xylostroma with that of rhizomorphs.

6. Rhizomorphs are not found in natural conditions, but can be readily induced to form in laboratory culture.

7. The causative fungus is a virulent parasite not depending on wounding or previous infections for entry into the host.

8. Infection begins in lateral roots and extends into the main axis, where fissures are produced by interesting mechanical phenomena—*i.e.*, rupture of the wood tissue by plates of xylostroma originating in medullary rays.

9. Thoroughly lignified cell-walls are not destroyed.

10. Transmission is by actual root contact.

11. The only significant environmental factor correlated with severity of attack is excessive humidity.

12. Control is effected by reduction of humidity, destruction of morbid material, and isolation of the affected areas; occasionally by therapeutics.

13. Legislation has been found necessary in the Gold Coast and Togoland to ensure effective control, and has been instituted.

H. R. B-J.

MR. T. GILL, Forester of the Charles Lathrop Pack Forestry Trust and formerly Associate Editor of the American Forestry Association, has become Associate Forester of the Tropical Plant Research Foundation, and will conduct a survey of the forest resources of tropical America supported by the Charles Lathrop Pack Forestry Trust.

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

The determination of Fertilizer requirements of a Soil by means of Plant and Soil analyses.

It is generally admitted that the quantitative fertilizer requirements of a crop cannot be gauged purely from a chemical analysis of the soil. This fact is emphasized by the experiments of W. Lange who made an intensive study of 6 typical soils by means of vegetation experiments and by various methods of analysing the soil and the plant. Neither the solubility of soil P_2O_5 and K_2O in HCl nor the molecular proportion of SiO_2-Al_2O_3-bases (method of Ganssen) gave satisfactory indications of the fertilizer requirements of the soil (as determined by vegetation experiments). The Neubauer and Schneider method (*C. A.* 18, 877) gave qualitative indication of the requirements for the various fertilizer constituents as did also the relative solubility of the P_2O_5 in 1% citric acid (Lemmermann's method).—(*Z. Pflanzenernähr Düngung.* 6A, 1926.)

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Recovery of Sucrose from Cane Molasses.

The recovery of sucrose from cane molasses continues to engage the attention of Sugar Technologists in various parts of the world. In the *Quarterly Journal of the Indian Chemical Society* (1926, No. 3), Watson, Mukerjee, Gupta, and Chaturvedi discuss the possibilities of the Batelle process.

With slight modification the process might be suitable for the recovery of sucrose from cane sugar molasses as a process by itself, viz.: by diluting the molasses and boiling with lime to destroy the invert sugar, then precipitating the sucrose as tricalcium sucrate, filtering, and treating with carbonic acid to liberate the sucrose.

In this paper are described a number of experiments designed to establish the optimum conditions for the destruction of the reducing sugars by liming, boiling, and carbonating, but very irregular results were obtained, and no definite conclusion was obtained. One of these experiments was made in the following way: To a 12 per cent. solution of sucrose, an equal amount of caustic lime in a finely ground condition was added, the mixture stirred for four hours at a temperature of zero to 6°C., and the precipitate collected; then the filtrate was boiled with another 15 grms. of lime and the above procedure repeated, the precipitates being united and carbonated off, when the total final recovery of sucrose obtained was 84 per cent.

Other recoveries were: (1) from a mixture of sucrose and glucose, 77·5 per cent. (2) from molasses with 43 per cent. sucrose and 20 per cent. sucrose, 66 per cent. These authors found the calcium sucrate precipitated in their experiments to have a solubility much greater than is recorded in the literature of this compound; and they remark that it would seem as if the calcium sucrate obtained in their tests were not the true compounds so that if the conditions could be found for separating the true calcium sucrate, the problem would be solved. However, they consider the results obtained by them to be promising from the commercial standpoint, having realised a recovery by the simplest process of 84 per cent. of sucrose in the form of syrup of 70° purity which they calculate would give them 24 of sugar per 100 of molasses treated. Taking the cost of the molasses (100 md. at Rs. 200) and of the lime used (60 md. at Rs. 45) and the value of the sugar (24 md. at Rs. 288) and the molasses (24 md. at Rs. 48) recovered, they regard the difference (viz. Rs. 90) to be a considerable margin for working charges.

* * *

Boiling Practice in Philippine Islands.

W. Patterson (third Annual Convention of the P.S.A. 1925) writes that a two-week run was made to compare (1) the "two boiling system" (returning molasses to each strike and boiling to approx. a constant purity) with (2) The system at Pioneer Mill, T.H. In method (1) the first massecuite was boiled at 73·5° purity, taking back molasses into each strike giving first molasses of about 54° purity for the low grades. In following the Pioneer system, the A, B and C massecuites were boiled at 86, 77 and 74 purity respectively and the low grade at 54°. A small difference was found in favour of the Pioneer method, calculations based on actual purities attained showing a saving of 250 tons of massecuite per week under conditions practically the same as regards grinding, syrup and remelt purities; which saving was actually a material reduction in extra fuel consumption. In the two boiling method or any other where low grade seed is used for making commercial sugar, proper attention should be given to grain formation, when making low grade sugars. After this the author states general rules in regard to sugar manufacture for the refineries. Crystals that are hard and regular will give higher returns than irregular, soft grains. A uniform grain will facilitate affination at the refineries. It is important to boil with a high vacuum in the evaporators and pans, so that viscosity will be reduced to a minimum, and the colour of the sugar will not be affected by high temperatures. For the manufacture of a sugar of good colour, a standard sample of sugar, acceptable by the refiner in grain and appearance should be given to the head sugar-maker to guide him. Obviously one must make sugar to suit the refiners' requirements, not the manufacturer's. Boiling to a fixed standard makes work more interesting, and creates a keener interest, making for better work and better sugar.

REVIEWS.

THE ECONOMIC REVOLUTION IN BRITISH WEST AFRICA. Allan McPhee (pp. xii, 322) George Routledge & Sons.

Under the several headings of Trade, Transport, Land, Finance, Currency, Natives and Health, this interesting work contains a mass of detail regarding the advancement in each of the four Dependencies of West Africa during the years of British influence. It is perhaps inevitable in a volume which covers so much ground and which concerns countries which change from day to day that there should be a minor degree of inaccuracy with regard to details, and that there can be no finality about the closing pages. In writing a history, the information can cease at a definite date, but with a work of this description there is no end to development, and the author must draw the line when he can and where he will. Thus, in the earlier sections on Trade and Transport, the information given seldom runs beyond the year 1923, whilst the chapters on Natives and Health were obviously written at a later date and based on more recent information. The author himself would doubtless be the first to agree that great strides have been made in matters relating to Trade and Transport during the last four years. Throughout the closely printed pages there is displayed a keen sense of the immense difficulties with which the Governments of West Africa are faced. The author describes the situation most succinctly in his Introduction "In fact, the process since the "Nineties of last century has been the super-"imposition of the twentieth century after "Christ on the twentieth century before Christ."

That these peoples still to-day shackled in some cases by physical slavery (*vide* page 254) and far more greatly fettered by superstition, ignorance and savagery, have to be led by short cuts across the centuries which Europeans traversed by many winding paths is now the supreme difficulty and responsibility of the British. In few cases does the author underestimate the obstacles in the path of civilization, nor does he often fail to lay an unerring finger on vital questions. From his marshalled facts concerning the past it is possible for him to make some shrewd forecasts concerning the future which may be said to rest on Trade, Transport and Education.

The burning questions of land tenure, and deforestation through "Chena" culture and otherwise, are clearly set forth, though the answers to them are still hidden in the womb of time. But that the foundation of Trade is Agriculture cannot be doubted, despite the vast mineral wealth and its modern exploitation, and the introduction and development of new crops must be considered. The Oil Palm, that vast source of potential wealth, that has only fallen into deeper neglect with the rise of Cacao, is merely hinted at.

Transport programmes are being extended and speeded up daily. The West African native has a keen sense of the value of roads, the benefits are obvious from the outset, and the co-operation of Chiefs in providing labour is usually willing and eager. What progress lies behind the reference, in the Annual Report of the Chief Commissioner of the Northern Territories of the Gold Coast for 1925-1926, to a Native proprietor of six motor lorries who only charges one-way fares!

In Education there are many years of arduous toil to be faced. The author hardly stresses sufficiently the initial complication arising from the many languages spoken, the scarcity of competent Native teachers, and the results of the unsuitable nature of the curriculum (page 260, note 2) dealt out, in all good faith, by philanthropists and missionaries in past years. On this subject there is one important point which is not mentioned in the book: the question of the education and the future position of the women.

The education of women, initially in the simpler forms of Hygiene and child welfare, is essential for progress. Quite a superficial survey of the situation is sufficient to shew the effect of the present one-sex advancement and its involved reactions upon a family, and there is no evidence that the women of West Africa will not, in time, be able to meet the men on an equal footing. The necessity of the moment is an educational policy which will inspire in the average man and woman a sense of responsibility toward the future of the country, and to demonstrate that the active life of a farmer and producer is even more dignified than that present general desideratum, the stool of a government clerkship.

Though it mainly deals with past achievments, a unique array in the annals of the civilised world, this book must find a place on the shelves of all who hope to see the "White Man's Grave" take its rightful place in the world's history through the medium of British wisdom and forethought.

J. K. H.

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WEST INDIAN READERS, BOOKS I, II and III. J. O. Cutteridge, Senior Inspector of Schools, Trinidad and Tobago. Thomas Nelson and Sons, Ltd. Price 1*s.* 4*d.*, 1*s.* 6*d.*, and 1*s.* 8*d.* respectively. Illustrated.

It is evident that Captain Cutteridge has made ample use of his undoubted wealth of teaching and local experience and he is heartily to be congratulated on the result. In the absence of such a series, reading has hitherto been confined to subjects essentially English, while the scholars have never had the opportunity of seeing, in print words in daily use. The reading matter is not only important and valuable but is also presented in a manner best calculated to arouse the interest of the scholars. At the end of each lesson is a valuable exercise designed to test the degree to which the subject matter has been assimilated. The illustrations, particularly those dealing with local features, are exceptionally good. The West Indies, British Guiana and British Honduras are fortunate in having as author and compiler an officer of the ability of Captain Cutteridge.

C. Y. S.

COTTON. By H. B. Brown, A.M., Ph.D. McGraw-Hill Book Co., New York, 1927. Price $5.00.

This work is a great improvement on any of the general text-books on the cotton crop in all its aspects which have yet appeared. The scope and arrangement of the chapters leave little to be desired, and the technical production of the book is excellent. Nevertheless, the reviewer lays it down with disappointment, and feels that a first-rate book on the subject is still wanting.

The chapter on Taxonomy, written from a genetic point of view as it should be, is marred by total neglect of the fundamental distinctions between New World and Old World cottons, and in the chapter on the form and structure of cotton plants a much clearer description might have been given by following the lines of Harland's paper mentioned briefly on p. 110.

These may be matters of opinion, but there are more serious defects. There is no excuse, in a book dated 1927, for quoting an opinion that the twisting of cotton hairs is caused by the closing of simple pits in the wall, and leaving that as the last word on the question. Then under "Cotton Stainer" we are amazed to read that the staining of lint "is done by the excrement from the insects and by the juices from their bodies when they are crushed in the picking or ginning process"!

The truth seems to be that scientific literature on the cotton plant and its lint published outside the U.S.A. during the last fifteen years has been almost entirely ignored.

It must be admitted that had it been included, the book must have been bulkier, for Professor Brown covers an enormous amount of ground in his five hundred pages. On a rough division, ten chapters are botanical, dealing primarily with the plant, seven are agricultural, dealing with the crop, and including ginning, and eight are economic, on marketing and uses. Cotton, treated in this way, is a very big subject for one man to handle in one book, and some defects were almost inevitable. Still, it seems a pity that the author did not raise the first seventeen chapters, in which as a cotton breeder he is presumably most interested, to first-class standard, even if it involved making the economic section, which contains a lot of information valuable to the cotton grower, into a distinct volume.

E. E. C.

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ORWIN AND KERSEY: Estate Accounts, pp. viii, 46. Cambridge University Press, 1926. Price 3*s*. 6*d*.

Amongst the many books on agricultural book-keeping few have appeared on estate accounts, and, as accurate and well planned accountancy leads to more scientific control, some system will be found profitable and informative. This system should fulfil two purposes; it should enable the agent to account accurately for money received and spent on behalf of his principal and should supply information to aid in the wise administration of the property. The system propounded by the authors in Chapter 2 and exemplified in Chapter 3 seems to meet these needs in a simple and efficient manner. The whole process consists in entering all receipts and payments in the Cash Book, and, in posting them from the Cash Book to their appropriate Ledger accounts making an analysis of the figures. At the end of the year the Ledger Accounts are closed, balances in certain cases (*e.g.*: "sporting account") carried forward to other ledger accounts and finally to the "Revenue and Expenditure Account," the balance of which shows the net available income. One paragraph in the book should call for comment and criticism from those interested in accountancy on tropical estates—"Estates accounts are kept, usually, on the basis of Income and Expenditure. It is neither necessary, customary nor desirable to take account of the Capital invested in the property. Indeed, the capital value is rarely known, and so much of that which might be regarded as capital expenditure, from year to year, represents no more than the replacement of wasting assets that any attempt to arrive at an initial figure, and then to add to it, or to subtract from it, according as money is laid out, or as assets depreciate, would be no more than to involve the accountant in a maze of figures having no substantial basis." The format of the book is up to the usual Cambridge standard.

G. W.

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A STUDENT'S MANUAL OF ORGANIC CHEMICAL ANALYSIS, by J. E. Thorpe and M. A. Whiteley, London, 1926, Lorgmans, Green & Co.

Dr. Thorpe and Dr. Whiteley are respectively Professor and Assistant Professor of Organic Chemistry at the Imperial College of Science, London, and their manual records twenty years' experience in the teaching of the methods of qualitative and quantitative chemical examination as applied to single organic substances and to simple mixtures thereof. By its employment, almost any common organic substance can be referred to its class or indentified outright, with precision and speed, provided the investigator has previously mastered the usual manipulative methods, and has completed a course of general organic preparations. The reactions of the commoner organic compounds are set out in detail (pp. 71-131), and full directions are given for the detection and estimation of radicles (pp. 133-216). In an appendix, a short account is given of the methods of micro-analysis of organic compounds, devised in 1911 by Dr. F. Pregl. In another appendix, certain entirely new methods of analysis, involving combustion and hydrogenation, are described by Professor Tel Meulen and Dr. Heslinger, of the Delft Technical High School, Holland. Several of these novel methods were demonstrated by Professor Tell Meulen at the Oxford Meeting of the British Association in 1926, and are rapidly being adopted in certain schools of advanced organic chemistry.

F. HARDY.

COLLEGE NEWS.

A Sugar Supplement is issued with the journal for this month.

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Lectures for the Session 1927-28 will begin on 10th October, 1927.

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Mr. G. Evans, M.A., C.I.E., Principal of the College will return to Trinidad by s.s. *Carare* on 29th August.

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Messrs. Springer and Davies who were awarded Sugar Certificates at the end of the last Session, sailed for Blairmont, Berbice, British Guiana on 21st August.

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The following appointment has been made by the Secretary of State for the Colonies.

Mr. C. B. Williams, Entomologist, Amani Institute, Tanganyika Territory.

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Mr. C. Y. Shephard, Professor of Economics, will represent the Imperial College of Tropical Agriculture at the Imperial Agricultural Research Conference to be held in London in the Autumn.

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Mr. E. E. Cheesman returned on 29th July by the s.s. *Canadian Skirmisher* from a visit to Montserrat, undertaken for the purpose of investigating the production of pure strain Sea Island cotton seed in that island.

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Professor F. Hardy returned on 6th August from a visit to the United States where he attended the First International Congress on Soil Science held at Washington 13th-22nd June, followed by a trans-continental tour, 23rd June-21st July.

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Messrs. W. Allan, A. C. Bebbington, H. R. Hosking, H. Hutchinson, A. H. Lewis, R. M. Maynard, who have been elected to Senior Studentships at the Imperial College of Tropical Agriculture by the Empire Cotton Growing Corporation, are due to arrive in Trinidad on 8th October by the s.s. *Stuyvesant.*

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The following Colonial Office students are expected to sail for Trinidad by the s.s. *Ariguani* on 26th September, arriving 9th October:—O. J. Voelcker, H. P. Smart, A. H. Savile, J. D. Broatch, N. V. Rounce, J. H. Palmer, J. L. Grey, G. N. K. Turnbull, E. W. Leach, J. E. Bruce, C. L. Skidmore, G. Gowan, G. E. Buckley, A. K. Briant, E. B. Martyn, C. B. Taylor.

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Commenting editorially on the impression created by Professor J. S. Dash, who has been promoted from the Imperial College of Tropical Agriculture to the post of Director of Science and Agriculture of British Guiana the *Daily Argosy* of the 23rd July says: "The new Director of Science and Agriculture, Professor J. Sydney Dash, has created a favourable first impression by the interview which was published yesterday, and when he has acquired a thorough knowledge of the agricultural potentialities and possibilities of the Colony it is to be expected that his sound knowledge of tropical agriculture, his practical mind and his modern outlook will prove of great value to the agricultural community."

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Mr. F. W. Urich has been appointed Assistant Professor of Entomology on the college staff. Mr. Urich who was a student of Zoology under the late Professor Carl Vogt in 1887-88 at Geneva University, has had a long and distinguished career as an entomologist. He devoted himself to entomological studies in Trinidad under direction of the late Professor C. V. Riley and Dr. L. O. Harvard, Head of the Entomological service of the United States Department of Agriculture between the years of 1889 and 1908, during which time special attention was paid to ants, mosquitos and tropical economic entomology. In 1909 he was appointed entomologist to the Trinidad Board of Agriculture, and in 1920, Entomologist on the staff of the Trinidad Department of Agriculture. This post Mr. Urich has held up to the present time.

Mr. Urich has specialised on the insect pests of sugar-cane and cacao and is an authority on the fauna of Trinidad. His services have in the past been requisitioned for the purpose of investigation and advice in other parts of the world, especially in Mexico in connection with froghopper of sugar-cane, and San Thomé, in connection with the pests of cacao.

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The Governing Body of the Imperial College of Tropical Agriculture, has offered the post of Professor of Agriculture, rendered vacant recently by the resignation of Mr. J. S. Dash who has accepted the post of Director of Science and Agriculture in British Guiana, to Mr. R. Cecil Wood. Mr. Wood who is at present in South Africa has accepted and is expected to arrive in Trinidad early in October.

Mr. Wood has had a distinguished career, and has an exceptionally wide experience of tropical agriculture. He is a Cambridge man, and took the Natural Science Tripos with honours and afterwards the University Diploma of Agriculture. On completion of this course he remained for a year at the University as Assistant Professor of Agriculture and then joined the Indian Agricultural Service, being posted to the Madras Presidency. For the greater part of his service he was posted to Coimbatore, and was Principal of the Madras Agricultural College, which was built during the early part of his service and which he was responsible for bringing into a high state of efficiency. In addition to training students for the Agricultural Department and for private work, the College carried out a good deal of original research, the main crops being rice, cotton, sugar-cane, ground nuts, millets. The College worked on close collaboration with the Indian Central Sugar Research Station which is situated close by, and has produced some well known seedling canes.

After acting as Director of the Madras Agricultural Department for a short while, Mr. Wood retired on a proportionate pension in 1922 and took service under the Empire Cotton Growing Corporation. As one of their scientific officers he has been engaged in research work in Tanganyika and in Swaziland for the last four years.

The staff of the college will welcome his arrival in Trinidad and will appreciate the fact that one of the most important departments at the college is to be placed in such capable hands.

DR. H. MARTIN LEAKE, M.A., Sc.D., F.L.S., F.Z.S.

An Appreciation of His Work as Principal of the College, 1924-26.

THE college has suffered a great loss through the retirement of Dr. Martin Leake, who was Principal for the last two and a half years Dr. Leake who took over the position from Sir Francis Watts, who was the first Principal, and to whose energy and foresight, the inception of the college was very largely due, was faced with a big responsibility. The wonderful progress made by the college during its short history is largely due to his energy, devotion to duty and singleness of purpose. In addition to possessing exceptionally fine scientific qualifications, he had many other of the necessary qualifications for the post, and in particular a capacity for looking ahead and of basing his policy accordingly. Those who have worked in conjunction with him on the spot most fully realize the unsparing way in which he devoted himself to the interests of the college, often at the expense of exercise and recreation and it is feared somewhat to the temporary detriment of his health. His record at the college remains as a permanent one. During his term of office the main college building was completed, the grounds were remodelled, and the curriculum revised. The staff has been greatly expanded, and the number of students greatly increased. It is largely due to his foresight that the college has now its own gas supply and is about to have an efficient electric power station, and the designs of the Milner Hostel and Dining Hall for the accommodation of oversea students, which are now nearing completion, are in the main drawn up according to his plans, and in accordance with his policy.

These are only a few of the instances of his work and he can at any rate rest assured that whatever the future may hold for him, his name will invariably be remembered as one of the greater builders of this institution.

The college staff wish him the best of good fortune in the future.

G. E.

ON 16th May, the Empire Marketing Board gave a private luncheon to the Premier of Queensland (Mr. W. McCormack), at which the Secretary of State for the Dominions (Mr. L. S. Amery) presided. An informal discussion took place, principally relating to the proposal to establish a tropical agricultural research centre in Queensland, which Britain proposes to subsidise.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—The July market remained uninteresting the most marked feature being the extreme stability of futures. The firmness in New York is ascribed by Messrs. Czarnikow to proposals to restrict the 1927-8 Cuban production to 4,000,000 tons, limiting the quantity for export to United States of America to 3,500,000 tons, and to form a Cuban Corporation for the disposal of the balance to countries outside the United States. The Cuban President has so far made no official pronouncement but it is thought in some quarters that he would favour such a measure. Prices (22nd August) were as follows: London (per cwt.) Foreign 96° c.i.f., 13*s*; Preferential, 16*s*. 4½*d*.; Yellow crystals, landed, duty paid, 30*s*. to 34*s*. 6*d*. New York (per 100 lb.) Cuba, 90° c. and f., $2.70.

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COTTON.—A sharp decline occurred at the beginning of August (3rd August, Mid. Am., spot, 9.30*d*.). Although some sections are poor, crop accounts on the whole continue good.

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COCOA.—Sales effected just before the close of trade for July included Arriba at 93*s*. 6*d*., St. Thomé at 79*s*. and 80*s*. 6*d*., Costa Rica 75*s*. and 76*s*. 6*d*., very fine Caracas 125*s*., Bahia (Brazilian) 75*s*. 6*d*., and Cameroons 75*s*. per cwt. Quotations (22nd August) for Trinidad L.L.T., and Grenada L.L.T. per cwt., were 81*s*. to 86*s*. and 78*s*. to 79*s*. In New York Trinidad estates, ex quay, per lb., stood at 16c. and Grenada at 15¾c.

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COFFEE.—Enquiry is for the better grades of coffee which are in short supply. At the beginning of August, Santos, Rio and other Brazilian sales showed a recovery. Sales included Blue Mountain 210*s*.; very fine Costa Rica, 190*s*.; bold Nilgiri, 152*s*.; fine Masagogipe 200*s*.; and finest short berry Mocha at 155*s*.

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COPRA.—Sales of copra included in the last six trading days of July; Zanzibar, £25 12*s*. 6d.; Seychelles, £26 13*s*. 9*d*.; Java, £26 12*s*. 6*d*.; and Cebu, £25 11*s*. 3*d*. per ton. West Indian, c.i.f. per ton was valued at £26 10*s*. 0*d*. on 22nd August; the New York quotation of the same day was $5.25 per cwt. c.i.f.

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RUBBER.—Over the August holidays prices showed little change. Quotations on 4th August were, E.P. spot crepe 1*s*. 5½*d*.; E.P. spot rubber smoked sheets 1*s*.5⅛*d*.; hard fine Para, spot, 1*s*. 3¾*d*.